

Chapter Five

The Future of Air Quality in Our National Parks

Background

Since the late 1970s the National Park Service's air resources management program has grown steadily due to the importance that NPS and individual park managers placed on protecting this critical resource. Throughout this period, NPS placed a heavy emphasis on the collection of credible air quality information for its parks to support scientifically sound resource management decisions. This included information on air quality, its transport and fate in the atmosphere, and the effects on park resources and ecosystems. As part of its affirmative responsibility under the Clean Air Act, the NPS also assumed a larger role in the protection of parks and their resources from new sources of air pollution and a more visible role in national and regional initiatives to control air pollution. Protecting parks from new sources has been done through the review and comment of over 700 permit applications for new or modified sources of air pollution located near our national parks as required by EPA's Prevention of Significant Deterioration and New Source Review regulations. NPS has articulated its mission and need for good air quality in our national parks in many decision-making arenas, such as the Grand Canyon Visibility Transport Commission, the Southern Appalachian Mountains Initiative, and the Western Regional Air Partnership. It has fostered and maintained numerous partnerships with a diversity of private and public governmental and non-governmental organizations. Efforts to make park visitors and the general public more aware of air pollution issues faced by NPS have also been expanded using new Internet-based technologies. All of these efforts have been vital to the development of a successful and effective air resource management program.

NPS has not had, nor will it likely ever have, the regulatory authority commensurate with its responsibilities to control the air pollution emissions that cause ecosystem effects and visibility impairment so often observed in parks. Consequently, NPS will continue to rely mainly on non-

regulatory approaches to achieve its air quality goals. New laws and regulations passed or that took effect during the 1990s, however, have been instrumental in some of the air quality improvements we are seeing in parks. The Acid Rain Provisions (Title IV) of the 1990 Amendments to the Clean Air Act and the Regional Haze Regulations have and will continue to have positive effects on park air quality related values. The new fine particle (PM_{2.5}) and ozone standards will require states to revise their State Implementation Plans. This will translate into further reductions in air pollution emissions and likely benefit the air quality at some of our parks. New regulatory approaches will likely be necessary, however, to ensure that air pollution does not continue to pose a threat to any national park.

Future air quality challenges

In spite of the gains over the last 20 years, some air pollution trends in many of our parks continue to need our attention. Ozone levels in parks (see Chapter Two) rose steadily throughout the 1990s despite the overall improvement in ozone levels in urban areas. Over the past 20 years, national ambient ozone levels in urban areas decreased 21 percent based on 1-hour data, and 10 percent based on 8-hour data, according to EPA. Over the past 10 years, ozone 8-hour levels in 29 parks have increased by 4 percent, with some parks showing increases of nearly 20 percent. Nitrogen deposition levels in parks are generally on the rise causing a greater concern for nitrogen-saturated forests. Other effects from known and unknown environmental pollutants are likely going undetected because NPS lacks sufficient information about these pollutants or their effects.

Challenges

Some of the challenges the NPS will face arise from our experience over the past 20 years in trying to achieve better air quality for parks and their visitors. Some of these challenges reflect emerging issues such as those related to climate change and toxic airborne contaminants



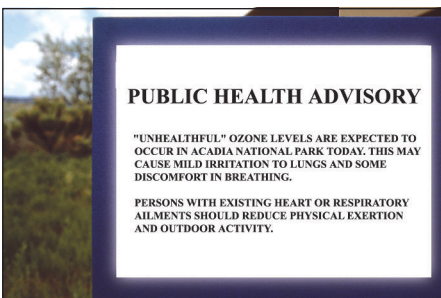
Air quality interpretive displays, such as this one at Grand Canyon National Park, is only one way that the National Park Service informs the public about air pollution and how it affects national parks.

"... the quality of the air around Mount Rainier National Park serves to galvanize support among all the interested groups, governments, and the general public into actions that protect the entire region."

*Jon Jarvis, Superintendent
Mount Rainier National Park, Washington*



Smoke control measures can reduce the air quality impact of prescribed burning.



Some parks, such as Acadia National Park, often post health advisories for its visitors due to unhealthy levels of ozone (smog) measured in the park. High pollution days are usually associated with the long-range transport of polluted air masses that have passed over large urban areas along the eastern seaboard.

whose effects are largely unknown and yet to be investigated. Others reflect unanswered scientific questions on how air pollution is affecting park resources and ecosystems or arise as a result of some of the inadequacies of the current regulatory framework to mitigate air pollution effects in parks.

One clear message that has emerged over the past 20 years, however, is that good air quality in national parks cannot be taken for granted. It will require continued NPS involvement in the nation's air quality agenda, continued scholarship by researchers on air pollution effects, and enhanced public awareness and participation.

Visibility Achieving natural visibility conditions in parks over the next 60 years, envisioned by the Regional Haze Regulations, will be a major challenge. NPS must work in partnership with EPA, states, tribes, and regional planning organizations in developing strategies to achieve this goal. NPS will provide data on air quality conditions in parks, and assist states as they track progress toward the national visibility goal. Research to identify source categories contributing to visibility impairment and to differentiate smoke-related from industry-related carbon aerosols will need to be completed so that proper accountability measures can be developed to ensure that the national goal is realized.

Atmospheric deposition Under current levels of atmospheric deposition some parks are receiving inputs of air pollutants beyond the critical load levels necessary to maintain healthy ecosystems. Sufficient research and monitoring, however, that would help the NPS determine these ecosystem-dependent critical loads is lacking for most parks. Our challenge will be to initiate targeted research, monitoring, and modeling of dose-response relationships to identify these levels. Of particular concern is the increasing levels of nitrogen deposition in many of our parks, and the effects that this may be having on park ecosystems. Continued research on how best to estimate dry atmospheric deposition and accurately extrapolate measurements from a single monitoring location to entire ecosystems will also be necessary.

Ozone and other criteria pollutants A continuing challenge will be to track ozone trends and concentrations in parks, to assess effects on visitor health and sensitive vegetation. To meet this challenge, the NPS must continue monitoring so that data are available to detect changes in ozone and other pollutants over the long-term. Research into the formation and transport of elevated levels of ozone in national parks must be continued as part of the North American strategy. Our ability to link ozone concentrations to changes in plant health in parks will need improvement, and NPS will work with other federal agencies to ensure that this research occurs in these national parks most threatened by ozone.

Smoke management Fire is a potential major source of air pollution; it also plays an important role in many forest ecosystems. The protection of human health and air resources including visibility must be given full consideration in fire management planning and operations. Throughout most of the twentieth century, the occurrence of fire in natural ecosystems of the United States has been greatly diminished by land management practices, such as fire suppression. Through the exclusion of fire and its effects on natural systems, many wildland areas are now in an unhealthy state due to unnaturally high fuel loadings, the presence of plant species that are not endemic to these areas, and increased susceptibility of plant species to insect infestations and disease. As demonstrated by the many recent major wildfire events in western parks and wilderness areas, wildland areas are now prone to catastrophic fires largely due to conditions brought about or enhanced by decades of fire exclusion. A major challenge will be protecting human health and air quality while restoring fire-dependent forest ecosystems to their natural, wilderness character. Increased use of fire as a management tool must not impede progress being made in restoring visibility to natural conditions and complying with legal and regulatory requirements related to human health, welfare, and safety.

Toxic air pollutants Little is known about the impacts of airborne toxic compounds on park ecosystems. Some evidence suggests that persistent organic pollutants (POPs), pesticides, and metals may be de-

posited via atmospheric transport into parks. The NPS hopes to gain sufficient knowledge over the next decade to assess the exposure, accumulation, and impacts of airborne contaminants in key park ecosystems. In addition, mercury exposure and accumulation up the food chain will continue to be an issue in eastern and northeastern parks. Some parks have fish consumption advisories for humans, due to high mercury levels, yet little is known about the effects of high mercury levels on fish and wildlife in parks.

Park emissions The NPS Environmental Leadership Initiative directs NPS to manage the parks in a manner “that demonstrates sound environmental stewardship by implementing sustainable practices in all aspects of NPS management...” To achieve these objectives, it is necessary to understand air pollution emissions that result from activities within parks and to reduce these emissions as much as possible. In recent years, the NPS has developed emissions inventories for several parks. This is aimed at quantifying emissions from park sources, identifying strategies for reducing emissions, and ensuring compliance with state and local air regulations. The NPS has found that prescribed burning is typically the largest contributor to park emissions, and these emissions will be minimized using best smoke management practices. Park and concessionaire operations and facilities, as well as visitor vehicles, present the greatest opportunity for reducing emissions. Park emissions inventories will continue to be instrumental in guiding parks in developing sound management practices geared at protecting air resources.

Legislation and regulations New laws or regulations will likely be necessary to ensure that park natural resources and ecosystems are fully protected from the adverse effects of air pollution. EPA has set revised standards for ozone and fine particulate matter, which NPS hopes will benefit park ecosystems. Other than the Regional Haze Regulations requiring visibility conditions in Class I areas to be restored to their natural conditions, there are no current regulatory requirements for similar restoration or protection of other park “air quality related values”. Lacking new standards or regulations, park resources and ecosystems sensitive

to air pollution will continue to be adversely affected.

The designation of some national parks and wilderness areas as Class I under the Clean Air Act has afforded these areas special protection from air pollution emissions associated with new industrial facilities. This special designation provides an important tool needed to preserve air quality in these areas.

Cap and trade programs Cap and trade programs, such as the one developed under the Acid Rain Provisions (Title IV), can result in substantial reductions in air pollution emissions while minimizing air pollution control costs. By their very nature, these programs operate on a regional or national scale. Consequently, air quality gains at specific locations, such as national parks, cannot be predicted nor guaranteed. A mechanism must be found that would allow states and federal land managers an opportunity to ensure that their air quality management objectives are satisfied without impeding free market cap and trade programs.

Science and research NPS has a small, yet effective, science and research program supporting its air resource management efforts. The results of past air quality science and research activities have played a large role in this nation’s understanding of air pollution effects on park resources, investment in these science and research efforts will assure that decisions regarding air quality in parks are based on sufficient scientific information. More air pollution effects research must be conducted in national parks, and other agencies and academic institutions must be encouraged to use parks as outdoor laboratories. Research must be expanded beyond the natural and physical sciences to include scholarly research on economic and social science topics related to air pollution effects in national parks.

Education and outreach An informed public is vital for the societal changes needed to reduce air pollution to protect park resources. The NPS conducts education and outreach programs to help promote public appreciation and awareness of highly complex air quality issues facing the agency. A variety of media formats (Internet, publications, visitor service programs, etc.) must be used to com-



White River maintenance building at Mount Rainier National Park. Three hundred seventy-four photovoltaic panels provide 47 kW of power and reduce air pollution inside the park.

“The Pacific Northwest needs a comprehensive public transportation system. While we have little influence over the enormous investment required for a system for the Puget Sound, we can lead by example at the park.”

*Jon Jarvis, Superintendent
Mount Rainier National Park, Washington*



Clean mass transit bus systems like the one at Zion National Park is one of the innovative ways that the National Park Service is eliminating traffic congestion in parks. These systems have the added benefit of reducing air pollution caused by automobiles, diesel buses, and recreational vehicles.

Using the Internet

The NPS Internet AirWeb site provides for the exchange of air quality related information on air quality monitoring levels, regulations/policy issues, guidance to new source permit applicants, links to real-time images and air quality data in parks, educational materials, and publications. It also provides illustrations of the effects of air pollution on natural resources in NPS areas:

National Park Service AirWeb
<http://www2.nature.nps.gov/ard/>

In addition, the following parks have Web sites that show real-time visibility and air quality data:

Great Smoky Mountains National Park
<http://www2.nature.nps.gov/ard/parks/grsm/grsmcam/grsmcam.htm>

Acadia National Park
<http://www.hazecam.net/acadia.htm>

Grand Canyon National Park
<http://www2.nature.nps.gov/ard/parks/grca/grcam/grcam.htm>

Mammoth Cave National Park
<http://www2.nature.nps.gov/ard/parks/mac/macacam/macacam.htm>

Joshua Tree National Park
<http://www2.nature.nps.gov/ard/parks/jotr/jotrcam/jotrcam.htm>

Hawaii Volcanoes National Park
<http://www2.nature.nps.gov/ard/parks/havo/so2alert/havoalert.htm>

Big Bend National Park
<http://www2.nature.nps.gov/ard/parks/bibe/bibecam/bibecam.htm>

municate with the public, Congress, state legislators, and non-governmental organizations. Interpretive exhibits, including interactive ones like that at Great Smoky Mountains National Park, must be used more to inform park visitors on air quality and what actions they can take to improve air quality conditions in parks. NPS will also need to manage, analyze, and synthesize information and provide this information to the public, especially school-aged children, in a timely and routine manner using various approaches and in different languages. As this country's demographics change, the NPS air quality message will have to resonate with more diverse audiences, which will be an increasingly challenging task.

A strategy for the future

The framework that the NPS develops to meet future air quality challenges must be based on the successful elements of our air resource management program. It must also rely on three basic elements: communication, particularly with diverse audiences; collaboration and partnership with our numerous stakeholders; and environmental leadership, leading by example and holding ourselves to the highest standards.

Communicating our message

Our vision is a National Park System with air quality and other resources sensitive to air quality unimpaired by human-caused pollution...

from VISION STATEMENT
NPS AIR RESOURCES DIVISION

Communicating the NPS message regarding the importance of good air quality for parks to as many diverse audiences as possible is essential. Without public understanding and support as to why air quality is such a vital component of park ecosystems, NPS will be limited in its ability to meet its air quality goals. Before we can convey our air quality message to the public and others successfully, however, NPS as an organization must know and understand the importance of its message. Approaches to reach both internal and external audiences must be developed simultaneously.

In the past we have communicated our message and scientific information by disseminating a variety of air quality ma-

terials to internal and external audiences. Materials have included brochures, pamphlets, manuals, summary reports, slides, videotapes, exhibits, posters, scientific journal articles, and Web sites. Air quality information has been and must continue to be presented at technical conferences and professional association meetings, at congressional hearings, and at stakeholder meetings.

Public awareness programs in parks help promote public appreciation for preserving air quality in national parks. More NPS air quality information will be hosted on the Internet, including real-time air quality data collected at parks (see *Using the Internet* at left); data will continue to be formatted and accessible on the NPS Web site along with technical reports and findings. More air quality educational programs and lesson plans for all age groups must be developed and placed on the NPS Web site.

Working with others to improve air quality

The Air Resources Division, in partnership with parks and others, works to preserve, protect, enhance, and understand air quality and other resources sensitive to air quality in the National Park System.

from MISSION STATEMENT
NPS AIR RESOURCES DIVISION

The NPS will continue its cooperative efforts with other federal land management agencies (i.e., U.S. Forest Service, U.S. Fish and Wildlife Service, and Bureau of Land Management), Environmental Protection Agency, tribes, federal, state, and local governments, industry, and non-governmental organizations to ensure that air quality and related resources in parks are not adversely impacted by air pollution. Through this effort we hope to increase understanding of air quality conditions, trends, and effects as they relate to national parks. This information will provide a basis for future protection and enhancement of NPS resources. The collaborative efforts will include participating in multi-stakeholder partnerships, such as those listed in Table 5-1, reviewing and commenting on state and federal regulations and policies, and reviewing permit applications for proposed sources near the parks.

Table 5-1. NPS Air Resources Management Collaborative Efforts

Partnership	Participants	Purpose
Federal Land Managers' Air Quality Related Values Work Group (FLAG)	National Park Service (NPS), U.S. Fish and Wildlife Service (FWS), U.S. Forest Service (USFS)	FLAG is an interagency workgroup whose objective is to achieve greater consistency in the procedures Federal Land Managers use in identifying air quality related values and evaluating air pollution effects on these resources.
Southern Appalachian Mountains Initiative (SAMI)	AL, GA, KY, NC, SC, TN, VA, WV, National Park Service, U.S. Forest Service, Environmental Protection Agency, industry, environmental groups, academia, interested public	SAMI's mission is to identify and recommend appropriate measures to remedy existing and prevent future adverse air pollution effects on air quality related values of the southern Appalachians.
Visibility Regional Planning Organizations (RPOs)	National Park Service, U.S. Fish and Wildlife Service, state and local air quality agencies, industry, Indian tribes	The five RPOs (Western Regional Air Partnership, Midwest Regional Planning Organization, Central States Regional Air Partnership, Mid-Atlantic/Northeast Visibility Union, and Visibility Improvement State and Tribal Association of the Southeast States) are comprised of multi-state agencies that coordinate each state's development of plans to address regional haze.
Regional Air Quality Partnerships (RAQPs)	Federal Land Managers, states, Environmental Protection Agency	RAQPs are voluntary, ecosystem-oriented cooperative groups that have formed to deal with regional air pollution and its impacts on air quality related values.

Environmental leadership The NPS will continue strong support for its Environmental Leadership Program, which focuses on reducing the footprint NPS operations leave on the environment, and on ensuring exemplary environmental performance in NPS facilities. The plan for demonstrating environmental leadership focuses on air and water resource protection. Maintaining and restoring the air quality and water resources in national parks are essential to protecting all the resources of the National Park System, as well as the quality of the visitor experience. NPS has begun to improve its environmental stewardship by examining all maintenance, concessions, and other operations to improve sustainability and reduce environmental impact. An area where NPS can demonstrate this leadership is in the area of renewable energy. As of 2001, the NPS had over 700 photovoltaic applications in use ranging from single modules powering monitoring stations to the large 115 kW installation at Glen Canyon National Recreation Area. Building integrated, rooftop mounts and

ground arrays will continue to be viable applications as renewable energy applications are implemented. Many remote field stations are converting from diesel generation to hybrid systems in the 30-35 kW range.

In-park emissions The NPS is proposing to address area, mobile, and stationary air pollution sources within parks. The NPS can minimize air pollution emissions in parks through the use of best management practices related to park transportation planning, operations and maintenance, vehicle emissions, smoke management, and energy conservation. Pollution prevention could take the form of energy conservation, using alternative energy sources, and substituting polluting practices with less polluting practices. This could be accomplished by applying cost-effective pollution prevention practices rather than by installing expensive pollution control equipment. Park operation and maintenance is an area where the NPS is currently experiencing successes in pollution prevention. For ex-

“Obstructed views strike the heart of the reason we human beings love Acadia.”

*Jim Vekaki, Chief of Maintenance
Acadia National Park, Maine*

Renewable Energy in the Parks

Proud NPS employees at Joshua Tree National Park pose by the 14 kW photovoltaic/propane system installed at the park's Cottonwood complex. The system will provide 76 percent of the area's electrical requirements while eliminating 16,000 gallons of diesel annually.



The solar-powered entrance station at Lake Mead National Recreation Area is another example as how the National Park Service will rely more on renewable sources of energy in the future.



For additional information on the National Park Service's use of renewable energy systems visit <http://www.nps.gov/renew>.

ample, many parks have converted their paints to low-solvent formulations; thus reducing emissions of smog-forming volatile organic compounds (VOCs). Many parks are now using organic citrus-based or enzyme-based "degreasing" solvents that contain no VOCs. Road maintenance activities can also result in VOC emissions, some parks now use only VOC-free latex emulsion asphalt.

Mobile emissions Based on national park emission surveys, exhaust from vehicles is a major emission source within parks. On- and off-road vehicles are major sources of nitrogen oxides, particulate, carbon monoxide, and volatile organic compounds. The NPS is beginning to develop alternative means of transportation in some of the larger parks and, where feasible, converting fleet vehicles to compressed natural gas or electric power. To limit road dust, the NPS may minimize the application of surface traction treatments to those areas necessary for public safety. Those materials (usually sand) could be removed to prevent their dispersion.

Fire management air issues The Environmental Protection Agency has developed National Ambient Air Quality Standards for those particulates with a diameter less than 2.5 microns in diameter (PM_{2.5}). These standards are designed to protect sensitive portions of the public from adverse health affects. The standards are of interest to the wildland fire community because approximately 70 percent of the particulates emitted from biomass burning are in this size range. Also, the Regional Haze Regulations require states to develop programs and regulations to improve visibility in Class I air quality areas. To develop regulatory programs to implement the Regional Haze Regulations, states will need to consider controls on a variety of air pollution sources including wildland fire. As a result of these and other regulations and policies, the NPS

must address fire management/air issues in a coordinated manner with state, local, and other federal agencies. Through this effort the NPS will help develop guidance and internal policies that will ensure fire management air issues are properly addressed.

Energy conservation Because so many park buildings are old, they tend to be poorly insulated and energy inefficient. The NPS is evaluating the feasibility of improving insulation and otherwise reducing energy demand by installing more efficient appliances and lighting. Where feasible, new construction will include energy efficient heating and cooling and use sustainable building materials and practices by taking advantage of passive solar energy and natural shading. Where fossil fuels are still required for heating, the NPS will discourage the continued use of old-fashioned woodstoves or high sulfur fuel oil, and encourage conversion to natural gas; LPG; modern, clean-burning woodstoves; or lower sulfur fuel oil.

Responding to the challenge

How we as a nation respond to air quality challenges faced by the National Park Service will ultimately determine whether or not we leave our parks unimpaired for future generations. Fossil fuel consumption by industry and automobiles account for most of the air pollution affecting our parks. Reducing our consumption of fossil fuels by changing our lifestyles and relying more on renewable energy sources and sustainable practices will not only make this country less dependent on foreign oil but will also improve the quality of the air we breathe -- and that nourishes park ecosystems. More than 100 years ago Americans invented the concept of national parks as a way of preserving its natural and cultural heritage. Americans must demonstrate to the rest of the world that we indeed are willing to preserve and protect our heritage from the adverse effects of air pollution.